RESEARCH

Cariboo Forest Region

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EXTENSION NOTE #19
December 1996

Silvicultural Systems for Lodgepole Pine and Northern Caribou

RESEARCH ISSUE GROUPS

- **Soil Conservation**
- **Wildlife Habitat**
- **Hydrology**
- **Forest Health**
- **Reforestation**
- **Stand Tending**
- **Ecosystem Inventory and Classification**
- **Biodiversity**
- **Silvicultural Systems**
- **Guideline Verification**
- **Extension**

This Extension Note is based on the handout from a field workshop on Sept. 12, 1996.

Lodgepole pine grows in the Chilcotin in the very dry, very cold Montane Spruce (MSxv) and the very dry, cold Sub-Boreal Pine-Spruce (SBPSxc) subzones. Some of these forests are important habitat for northern caribou, an ecotype of woodland caribou. In winter, caribou seek lower elevation mature lodgepole pine forests in the MS and SBPS and forage primarily on approximately similar amounts of terrestrial and arboreal lichens. The Cariboo Forest Region supports the most southerly population of northern caribou in British Columbia and this herd is considered a key management species.

PAST MANAGEMENT PRACTICES

Clearcutting has been the predominant silvicultural system for lodgepole pine, since pine is well-adapted to naturally regenerating large disturbances, usually created by wildfires. By removing all mature pine, clearcutting removes the arboreal lichen, may impact terrestrial lichen through physical disturbance, and changes the microclimate for both types of lichen, . It may take many decades before the quantity of arboreal and terrestrial lichen within a clearcut is comparable to that in old stands. In this trial, alternative silvicultural systems are being tested for their effectiveness in reducing the impact of harvesting on caribou habitat, particularly on important lichen forage species.

CARIBOO-CHILCOTIN LAND USE PLAN

The Cariboo-Chilcotin Land Use Plan has delineated much of the caribou winter range in the area of this research trial for 'modified' harvesting. Operational harvesting will be conducted within portions of this Special Resource Development Zone in a manner that will minimize or mitigate impacts to wildlife habitat. Alternatives to conventional clearcutting are clearly needed for resource management compatibility.

RESEARCH TRIAL

A fully replicated research trial has been established in early 1996 following a pilot trial harvested in winter 1995. Initial results from the pilot trial were used to refine the treatments for the more intensive, long-term replicated trial. This Extension Note covers the technical aspects of each trial

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TRIAL OBJECTIVES

To determine:

- The impact of different silvicultural systems and harvesting methods on the abundance, diversity and health of terrestrial and arboreal lichens, particularly those species of lichen which are important caribou forage
- The effect of different silvicultural systems and harvesting methods on natural regeneration ingress and growth, and on survival and growth of planted lodgepole pine and interior spruce seedlings
- The amount and type of site disturbance resulting from harvesting the different treatments.
- The effect of the different silvicultural systems and harvesting methods on wildlife diversity, particularly the diversity and abundance of breeding birds and small mammals.
- The effect of the different silvicultural systems and harvesting methods on forest health, particularly the incidence of mountain pine beetle, pine engraver beetle and dwarf mistletoe.
- The impacts of two harvesting systems (stem-only and whole tree harvesting) on long term site productivity by both long-term experimentation and through ecosystem simulation approaches, and to identify sustainable management strategies.
- The impact of the different silvicultural systems and harvesting methods on the incidence of windthrow.

STUDY AREA

	Block 1	Block 2	Block 3	Block 4	Block 5
Subzone/site association	SBPSxc/01	SBPSxc/01	MSxv/04	MSxv/01	MSxv/01
Elevation (m)	1250	1317	1410	1497	1560
Forest cover label (pre-treatment)	Pl 822P 11	Pl 824P 7	Pl 824P 7	Pl 824P 7	Pl 824P 7
Age range (years)	--	–	110 - 210	–	193 - 275
Total area (ha)	111.9	103.3	95.7	60.2	65.6
Area harvested (ha)	88.4	76.5	68.4	44.6	50.8
Net merchantable volume (m^3/ha)	98.9	95.5	226.0	256.5	243.0
% volume removal	30% volume removal target (group selection) resulted in about 25% volume removal. 50% volume removal target (group retention) resulted in about 40% volume removal.				
Net merchantable vol./tree (m^3)	0.10	0.17	0.16	0.15	0.22

Site and stand information for the five treatment blocks

PROGRESS TO DATE

- Layout of the five replicated study blocks – three silvicultural systems/harvesting treatments and a control are replicated in each block.
- Sampling grids established in each treatment unit in all five blocks – approximately 50 permanent sample plots were established in each treatment unit.
- Baseline (pre-harvest) data collected: arboreal and terrestrial lichen diversity and abundance, coarse woody debris, natural regeneration, vegetation cover, small mammal abundance, breeding bird diversity and abundance, site characteristics.
- All treatment units in the five blocks harvested.
- Establishment of long-term productivity plots in Blocks 1, 2, 3 and 5.
- Post-harvest assessment of all sample plots for slash and disturbance.
- Re-assessment of permanent sample plots in pilot block.
- Sampling for cone abundance and establishment of seed release plots in Blocks 1, 3 and 5.
- Pre-harvest and post-harvest breeding bird surveys in all treatment units.
- Pre-harvest and post-harvest small mammal surveys in controls of all blocks.

PILOT TRIAL RESULTS

A pilot trial was conducted in 1995 to make some initial assessments of lichen response to selected silvicultural systems. Harvesting took place in the winter on a snowpack. The early results from the pilot treatments were used to determine the treatments for the replicated trial.

Treatments	Island Remnant	Group Retention	Group Selection
Description	30% volume left in islands of .25 to 1.0 ha	30% volume left in small groups of 10-15 trees.	30% volume removal
Effect on: Caribou	Poor lichen survival expected outside of islands	Many lichens not expected to survive and grow	Lichen more sheltered due to higher reserve volume, expected to survive and grow.
Natural Regeneration	High likelihood of success for all treatments. Disturbance is similar among treatments with possible exception around roadsides (reduced natural regeneration of lodgepole pine). The presence of thicker duff may reduce natural regeneration success.		
Biodiversity	Simulates natural disturbances; however, possibly higher reserve volumes	Not a natural stand structure	Possibly higher stand structure diversity than naturally occurring
Windfirmness	Minor problems may develop along island edges	Most residual stems prone to blowdown	Lowest risk since less opening
Forest Health	Islands selected based on low bark beetle or mistletoe incidence	70% removal can target much of the bark beetle and mistletoe-infected areas	Less removal reduces opportunities to harvest bark beetle or mistletoe-infected trees
Conclusion	Not a suitable treatment option for operational application on terrestrial lichen sites	Not a suitable treatment option for operational application, but higher retention may mitigate concerns with windthrow hazard & shading	Continue testing in replicated trial

Comparison of preliminary results from the three pilot trial treatments

REPLICATED TRIAL

The replicated trial consists of three treatments (detailed in table below) and a control (unharvested). The harvesting was conducted in January to April, 1996.

Treatments	Group Retention *On-Site Processing + Forwarding	Group Retention *'Conventional' equipment	Group Selection *On-Site Processing + Forwarding
Description	50% volume left in groups (20-30m diameter); small openings harvested of similar dimensions		30% volume removal through approximately 20m diameter groups
Logging System	Low ground pressure/no tail swing feller-buncher, matching processor working at stump, forwarding to roadside.	Low ground pressure/no tail swing feller-buncher, grapple skidding to roadside, processing at roadside.	Low ground pressure/no tail swing feller-buncher, matching processor working at stump, forwarding to roadside.
Anticipated Effect on: Caribou	Lichen survival and growth uncertain but higher probability of success than with greater volume removal. Some MS stands are this open naturally and have flourishing terrestrial lichen populations		Terrestrial lichen expected to survive and grow well due to lower removal. Most optimistic treatment option for harvesting to maintain arboreal lichen.
Regeneration	Natural openings of this size are believed to be adequate for natural pine regeneration but this has not been tested		
Biodiversity	2-layered stand does not occur naturally, although the openness of the stand is not uncommon		Does not simulate natural disturbance and resulting stand structure, but openings of this size are not uncommon naturally
Windfirmness	Substantially less concern than with 70% removal		Unlikely to be a problem
Forest Health	50% removal can focus on bark beetle and mistletoe-infected areas, but some mistletoe may remain in residual overstory stems		30% removal can only minimally target bark beetle and mistletoe-infected trees. Quality of residual stand and regeneration may be a problem in SBPS due to mistletoe.

Comparison of the three replicated treatments and anticipated results for meeting trial objectives

*The first two treatments (group retention with 50% volume removed) are identical in design but different in the harvesting systems used. These systems are compared in the following table:

	On-Site Processing + Forwarding	**'Conventional'**
Description	On-site felling, limbing, topping, cut-to-length, forwarding	No tail swing feller-buncher, grapple skidder, roadside processing
Advantages	Operates well on a snowpack No physical disturbance to terrestrial lichens	Little slash left in openings to impact terrestrial lichen Lower cost
Disadvantages	Terrestrial lichen under slash piles will probably not survive. Higher cost	Dragging of the slash could disturb terrestrial lichen more with inadequate snowpack. Skidder requires denser snowpack (due to lower flotation) to protect terrestrial lichen.

Comparison of Harvesting Systems for the trial

WINTER 1996 HARVESTING COSTS

*Hauling adds approximately $21.00/m^3 to these costs and takes 10-11 hours per haul cycle.

	Block 1 (SPBSxc/01, 99 m^3/ha)	**Block 5** (MSxv/01, 243 m^3/ha)
50% volume removal with forwarder	$33.37	$19.50
50% volume removal with skidder	$27.56	$27.77
30% volume removal with forwarder	$37.03	$20.39

Cost per cubic metre from tree to loaded on truck (includes road building)

INITIAL RESULTS OF BIODIVERSITY RESEARCH

LICHENS

- 96 terrestrial and arboreal lichen species documented by Trevor Goward and David Miege on the treatment sites
- Approximately ¾ of the lichens are terrestrial species
- Area is considered provincially significant for terrestrial lichen biodiversity
- One species found is new to BC
- One species found has never been identified
- Elevation affects lichen composition and abundance – correlated with humidity
- Arboreal lichens more abundant in Blocks 4 and 5 (MSxv); terrestrial lichens most abundant in Blocks 1 and 2 (SBPSxc)
- Arboreal lichen most abundant on spruce and has been heavily grazed by caribou
- Permanent plots will be re-sampled in 1998 to assess initial harvesting impacts

SMALL MAMMALS

- Live trapping, based on the Catch per Unit Effort Method, used before and after harvesting
- 182 animals trapped in 1995 (control only) – 5 species (deer mice, red-backed voles, common shrew, heather vole and yellow-pine chipmunks)
- 40 animals trapped in 1996 (control only) – 2 species (deer mice, red-backed voles)
- Annual decline may be caused by this last long winter with a deep snowpack followed by a cool, wet spring

BREEDING BIRDS

- Point count method used for sampling using 75m fixed radius plot and 12 min. timespan for observing or hearing
- 17 species of birds found inside the plots with another 8 species outside the plots
- None of the species found are unique to the subzones
- The Satah Mountain area has comparatively low density and diversity of birds
- Trial also includes a retrospective seral stage study and a riparian zone study

ADAPTIVE MANAGEMENT TRIAL

In conjunction with this research trial is an adaptive management trial with larger treatment units. This is being designed to further test the operational suitability of the group retention and group selection systems in the replicated trial. The two blocks are each over 500 ha in area with varied topography. Harvesting will commence this winter (1996/97) and will use the silvicultural system best suited to the specific site conditions. The second block will be harvested the following winter. Pre-treatment measurements for the first block are completed.

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